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author's extensive experience as a practical computer, combined with his keen mathematical insight, have enabled him to provide against the usual difficulties and pitfalls which beset the path of the beginner in this field.

The second part treats the more advanced parts of elementary trigonometry together with applications to simple harmonic curves, simple harmonic and wave motion, and harmonic analysis. The two parts are intended to cover the work in plane trigonometry usually given during the freshman course in the colleges. Notwithstanding the unusually large number of trigonometries which are now on the market, this book seems to have important characteristic properties.

From the standpoint of pure mathematics plane trigonometry may be of comparatively little importance, but it occupies a strategic point in the mathematical training of most students who take freshman mathematics in our colleges and universities. The numerous direct applications of this subject and the training which it provides for a wise use of approximate results combine to make it especially important that the student should have clear views at this point in order that mathematical thinking may become natural to him. Professor Wilczynski's book seems to guard to an unusual degree against vague or incorrect impressions.

Professor Dickson's *Elementary Theory of Equations* relates to a subject where both textbooks and students are much less numerous than in the subject considered above. The classic work by Burnside and Panton, in two volumes, is too extensive for the available time in many institutions. Moreover, it omits the important subject of systems of linear equations. Some of the more recent works aim to lead up to modern theories too rapidly to give enough room to the classic fundamental theories.

In the present book the author has provided for two courses by marking with a dagger many of the more difficult sections which could be omitted without breaking the continuity of the course. The aggregate of the sections thus marked is more than fifty pages,

and the rest constitutes a very brief course in this subject. A large number of illustrative problems are solved in the text, and about five hundred graded exercises are distributed through the various chapters. To the reviewer the book appears to excel all others extant for a first course in this subject.

As might be expected, the author has paid especial attention to rigor and conciseness in presentation, and has made a wise selection from the vast amount of material relating to the subject in hand. His masterful skill in reaching the essential points by the most direct means is everywhere apparent. In addition to a treatment of the rational integral function in one unknown, the book contains a good introduction to the theory of determinants and the solution of a system of simultaneous linear equations.

For the sake of simplicity very few modern concepts are introduced. The Galois theory is entirely omitted and the subject of invariants is only illustrated by a few examples. The concept of rank of a determinant is introduced but the closely related concepts of matrix and rank of a matrix are not developed. The introduction of these concepts would have enabled the author to state more concisely some results relating to a system of linear equations.

G. A. MILLER

Rubber and Rubber Planting. By R. H. LOCK, Sc.D. London, Cambridge University Press; New York, G. P. Putnam's Sons. 1913. Pp. 13 and 245. 5 by 7 inches.

The purpose of the author of this book has been to present an introductory outline of the subject, as stated in the title, to meet the needs of as wide a circle of readers as possible. One can not but feel that the result would have been more satisfying if the limitation of the size of the volume had not prevented the author from doing what he really wished to do. A better end could perhaps have been gained by confining the treatment to the most important rubber plant, economically regarded, *Hevea Braziliensis*. Had this been done, the least satisfactory chapters (II., X. and XI.),

scarcely more than summarily encyclopedic in their character, would have been omitted with little damage to the whole, and would have been more than compensated for by a still fuller treatment of the behavior of the *Hevea* tree under cultural conditions, a subject with which the author is familiar because of residence in Ceylon and intimate study of its plantations. Indeed, a complete presentation of his studies of latex flow and methods of tapping, bringing the whole of his work in one volume, would have been distinctly valuable to the planter and as much of the book is occupied by details which, in spite of the purpose of its author, are beyond the scope of, or insufficient for, the general reader, the only disadvantage would be found in a perhaps smaller market. The prospective planter, and, still more so, the person who still entertains the notion that rubber planting is a road to immediate wealth, will find plenty of material for an introductory study of the situation as regards rubber planting in the east; and if he has actually started on the venture, plenty of suggestion, of great value from the practical point of view. So that, while the reviewer thinks that the interests of a wide circle of readers have been misapprehended, and ill met, the book is most decidedly a good general introduction to the study of the problem of *Hevea* cultural methods in the far east, and would have been still more useful had the subject been extended and a fuller bibliography appended.

It would also have added not a little to the text in point of value to the intelligent student to have given specific citations of authorities on which the author frequently and properly depends, while a little further consultation of these would have obviated some minor insufficiencies and errors, as, for example, that made when it is stated that the methods of preparing guayule rubber are kept secret.

Plantation rubber has received its apotheosis, and it is with us to stay. The doom of wild pará, to say nothing of the inferior kinds, is as sure to sound as has that of guayule. No two economic plants have histories more full of romance than these, but, as those of early

history in general, exploration, adventure and exploitation of wild rubber fields must give way to plain, work-a-day methods. Civilized man does not hunt for his acorns and roots; he grows them. No more can he afford to hunt for his rubber; this also must be raised intensively and systematically, reducing costs and perfecting the product by the help of every scientific method at his command. In reading anew the history given by Mr. Lock of the attempt, now happily completely successful, to introduce the *Hevea* into the east, one's admiration of the pluck and faith displayed by the British, to whom everlasting credit must be rendered for their service, is again awakened. If Kew had done nothing more for civilization than this, the rubber producers of the far east could well take the support of that institution on their own shoulders for all time, and still never repay the debt. Botanical science needs the support of the business man more than he is willing at present to render. It is not inappropriate to say this at this moment when the big rubber companies are occupying the field. There are still new sources of wealth for science to search for, but science must work in its own way. We should like to see the man of business willing to take the long chance in the interests of science with the same *sang froid* as in the interests of business. He will be the gainer in the end.

Mr. Lock's account of the physiology of latex flow is valuable, but, at the same time, it shows us how far we are yet from having more than a very meager understanding of the whole subject. In this, the way to an accurate scientific study of the physiology of rubber secretion has been blazed out by the more immediately necessary practical tests so that the planter might have real guidance in handling the tree. The nature of the "wound response" characteristic of *Hevea*, is still to be closely studied. Here it may be remarked that the relation of yield to water-supply appears also to be antithetic to that observed in *Castilloa* and the Guayule (*Parthenium argentatum*), since the total yield and highest percentage of rubber in *Hevea* varies directly with the water

available (at least within the limits observed), according to our author, while the reverse is true in the other species just mentioned. Mr. Long might profitably have referred to Dr. Spence's experiments on *Hevea* in connection with his discussion of the functions of latex, about which we are indeed, as he states, very much in the dark.

No less important practically is the question of the nature of coagulation, and here also from now on careful scientific methods must be employed if further material progress is to be made.

Mr. Long's book indicates these and numerous other problems which await the attention of both planter and scientist, and because of this and because it contains a summary of practical results in plantation methods and management thus far obtained stated by an evidently careful student of practical methods, it will be worth study by every one interested. Tables of approximate costs and of data derived from tapping experiments based upon his actual experience in the east are given and the value of these is beyond question as offering guidance to those concerned.

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THE WORK OF THE U. S. FISHERIES MARINE BIOLOGICAL STATION AT
BEAUFORT, N. C., DURING
1913

THE laboratory of the Bureau of Fisheries at Beaufort, North Carolina, was opened to investigators engaged in the scientific and economic problems of the Bureau and to independent workers on June 9, and closed about the middle of September. The number assigned to the laboratory taxed its capacity and not all applicants could be accommodated. Following is a brief summary of the summer's work and of the various activities of the station during the year.

The equipment of the station was enhanced by the addition of beam trawls, a small fish trawl, stow-net, new pound-net, three new rowboats, a photomicrographic outfit, and numerous other articles needed in the laboratory,

power house and mess house. The most important addition was that of a 33-foot motor boat equipped with a 24 horse power 4-cycle 4-cylinder Lamb engine. This boat has a 10-foot saloon with suitable accommodations for extended trips and a large after deck, convenient for landing the beam trawls, boat dredges and fish trawls used at the station. It is a one-man control boat and is especially adapted to the needs of the laboratory. A new dark room for photographic work was built in one end of the laboratory. This replaced the one on the museum floor and added greatly to the conveniences of the laboratory.

The success attendant on the propagation of the diamond-back terrapin at this station has attracted considerable attention and a number of persons are contemplating engaging in this industry. Early in the year a company was formed at Beaufort and plans were perfected for growing terrapin for market on a large scale. The company has a well-equipped establishment with over 3,000 terrapin purchased for breeding purposes. The adaptability of this form to artificial conditions was shown by the fact that terrapin purchased during the laying season continued their activities in captivity and before the close of the season over 700 young terrapin had been added to the company's stock.

The 1913 brood of the laboratory numbered 1,424 on November 10. This is an increase of 198 over the brood of the preceding year. The average number of eggs per terrapin has steadily increased with longer periods of confinement. Those purchased in the early stages of the experiment, this year averaged over 13 eggs apiece. It was also quite evident from the number of eggs per nest that the terrapin in this pound laid twice during the season. In October, 554 terrapin belonging to the broods of 1911 and 1912 were planted in suitable localities in Lynnhaven Bay, Va., and 200 of the 1912 brood were sent to Chase, Florida, for experimental purposes. A brief account of the cultural experiments with this species by W. P. Hay and H. D. Aller is contained in Economic Circular No. 5 of the Bureau of Fisheries issued June 24, 1913, and entitled "Arti-